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Original Research

Dam's milk yield and growth performance of Black Bengal kids under semi-intensive production system in Bangladesh

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Abstract

The aim of the present study was to assess the dam's milk yield and growth performance of Black Bengal kids under a semi-intensive production system in Bangladesh. Data were collected from 7 bucks, 35 does, and 58 of their progenies and analyzed using the SAS computer program (2000). The result indicated that the survivability and growth performance of kids were significantly (p<0.05) affected by the milk yield, body condition score, and parity of does as well as buck. Moreover, the results also revealed that the litter size and milk yield of the does were significantly (p<0.05) affected by the body condition score and parity. The highest survivability of the kids was noticed in the case of dams with milk yield > 600 ml per day, body condition score 2, and parity 3. The highest birth weight (1.38±0.16 kg) and body weight at the different stages were found by using buck ID No. 01. On the other hand, in respect of milk yield and body condition score, the highest birth weight and growth performance were observed in dams with milk yield >600 ml per day and a body condition score of 3. However, the highest litter size (2.00±0.39) was observed in dams with a body condition score of 2. Similarly, in the case of parity, the highest litter size (1.60±0.5) was found in dams with parity 2. Besides these, the maximum milk yield was found in dams with a body condition score of 4 in parity 2, and the lowest in dams with a body condition score of 2 in parity 1. Therefore, the study revealed that the milk yield, body condition score, and parity of does play a significant role in the survivability and growth performance of the kids. So, it can be concluded that these factors must be considered for improving the growth performance and survivability of the kids.

Keywords: Black Bengal Goats, Growth Performance, Milk Yield

Introduction

The goat was the first ruminant livestock that was domesticated around 8000-11000 B.C (Luikart *et al*., 2006; Tapoi *et al*., 2006). Goats are found across all agro-ecological environments of the world. Goats in the country are kept mainly for meat production; their milk is rarely used for human consumption (Butswat *et al*., 2002). The average number of goats per household is found to be 2.31 and is mostly reared by landless, small, and medium farmers (Faruque, 2010). Goat plays a vital role in the economy of poor dwelling in diverse climatic conditions of Bangladesh (Kosgey, 2004). The goat is considered a "poor man's" cow which secured the second position after the cattle population (Ahmed *et al*., 2018) in Bangladesh and is mainly reared for meat production purposes. About 26.4 million goats are distributed throughout the country (DLS, 2020) among them the Black Bengal goat contributes to more than 90% of the goat population in Bangladesh (Rashid *et al.,* 2016). The Black Bengal goat is renowned for its high prolificacy, skin quality, and tasty meat (Husain *et al.,* 1995). The breed is early-maturing with first kidding occurring at about 12 months of age and twice a year or thrice in two years. But their productivity is below the expectation. This below-expectation production is due to several reasons like feed scarcity, disease, and so on. However, a high level of kid mortality represents a significant barrier to increasing the productivity of Black Bengal goats. The newborn gets the minimum amount of nutrients than they required due to insufficient milk of dams just after kidding. Therefore, the present experiment was undertaken to investigate the milk yield and growth performance of Black Bengal kids under a semi-intensive production system in Bangladesh.

Materials and Methods

Study Area

The present study was carried out at the BAU Artificial Insemination (AI) Center under the Department of Animal Breeding and Genetics.

Experimental Animals Care, Diets, and Management

All experimental animals were tagged individually before starting the experiment. The bucks were reared in individual pens (4.25 sq.). Regular deworming with Ivermectin (thrice in a year) and vaccination against *Peste des Petitis Ruminants* (PPR) were performed. A total of 7 bucks, 35 does and 58 of their progenies were used as experimental animals. The does were fed 120g commercial concentrate and ad-libitum green grass (Napier and/or German) per head daily in the morning and afternoon. In contrast, for bucks, 200g commercial concentrate feed, 50g gram, and 3 kg green grass was supplied per head daily in the morning and afternoon. The commercial concentrate feed (Surma cattle feed) contained ME 10.4 MJ /kg DM and CP 120 g/kg DM. Clean and fresh water was available at all times. The animals were managed semi-intensively. At the night, goats were kept in ventilated pens but allowed to graze and exercise during the day (between 10 AM and 5 PM) within the BAU, AI center premises.

Database Development

The body condition score of the does was estimated based on the filling of the muscling and fat deposition over and around the vertebrae in the loin region. The system used mostly based on a scale of 1 to 5. Body condition score cannot be assigned by simply looking at an animal. Instead, the animal must be touched and felt (Detweiler *et al.,* 2008). The birth weight of the newly born kids was taken immediately just after birth with the help of a digital measuring scale. The bodyweight of the kids was also taken at 1, 2, and 3 months of age in the early morning before feeding and watering. The milk yield of the does was recorded fortnightly from the 15 days of kidding to the end of three months with a 15 days interval. Before that, the kids were kept separated from the does during the previous night. The amount of milk obtained was double to get 24 hours of milk yield. Kid survivability is referred to as the ratio of kids surviving at a certain age in respect of the total number of kids born. However, all the information was recorded in an individual data sheet for each animal.

Statistical Analyses

Data were analyzed using the SAS computer program. Simple ANOVA was done considering buck, body condition score, parity, and milk yield as class variables. To see the significant differences among mean values, Duncan's

Multiple Range Test (DMRT) was performed.

Results

Table 1: Effect of body condition score on litter size and milk yield of does

BCS	LS	15 days milk yield (g)	30 days milk yield (g)	45 days milk yield (g)	60 days milk yield (g)	75 days milk yield (g)	90 days milk yield (g)
2 (20)	1.15^{b}±0.36	294.00^{a}±103.79	277.00^{b}±101.16	282.50^{a}±108.96	262.50^{b}±110.70	247.00^{b}±121.36	188.50^{b}±71.18
3 (13)	1.62^{b}±0.65	350.00^{a}±196.85	323.85^{ab}±103.56	297.69^{a}±87.95	286.15^{ab}±62.52	274.62^{ab}±121.63	234.62^{ab}±92.16
4 (3)	2.00^{a}±0.39	366.67^{a}±152.75	486.67^{a}±280.24	380.00^{a}±72.11	458.33^{a}±123.32	433.33^{a}±57.54	366.67^{a}±57.74
Pooled	1.59±0.33	321.78±116.52					

The figure in the parenthesis indicates the number of observations; BCS= body condition score; LS= litter size; Means with different superscript (s) in the same column differ significantly ($p<0.05$).

Table 1 shows the effect of body condition score on litter size and milk yield of does. The body condition score does have a significant effect on 30th, 60th, 75th, and 90th-day milk and litter size. The highest milk yield (486.67 ml) and litter size (2.00) were found in dams with a body condition score of 4 and the average daily milk yield ignoring the effect of body condition score was 321.78 ml.

Table 2: Effect of parity on litter size and milk yield of does

Parity	LS	15 days milk yield (g)	30 days milk yield (g)	45 days milk yield (g)	60 days milk yield (g)	75 days milk yield (g)	90 days milk yield (g)
1 (20)	1.33^{b}±0.54	304.06^{b}±113.93	306.56^{b}±134.56	289.36^{b}±100.09	285.31^{a}±111.56	261.25^{b}±117.96	211.56^{a}±87.92
2 (15)	1.60^{a}±0.50	357.14^{a}±213.81	390.00^{a}±129.79	321.07^{a}±133.33	271.79^{ab}±131.03	282.86^{b}±148.76	232.14^{a}±123.42
3 (1)	1.33^{b}±0.57	340.00^{a}±84.85	440.00^{a}±56.57	230.00^{a}±98.99	300.00^{b}±100.0	190.00^{a}±155.56	150.00^{b}±70.71
Pooled	1.42±0.53	286.84±111.82					

The figure in the parenthesis indicates the number of observations; LS= litter size; Means with different superscript (s) in the same column differ significantly ($p<0.05$).

Table 2 shows the effect of parity on litter size and milk yield of does. The parity of the does have a significant effect on 15th, 30th, 45th, 60th, 75th, and 90th-day milk and litter size. The highest milk yield (440.00 ml) was found in dams in 3rd parity and the average daily milk yield irrespective of parity was 286.84 ml.

Table 3: Effect of buck on growth performance and survivability of kids

Buck ID	Birth wt. (kg)	30 days body wt. (kg)	60 days body wt. (kg)	90 days body wt. (kg)	Survivability (%)
1 (2)	1.38^{a}±0.16	3.92^{a}±0.45	5.71^{a}±1.25	7.01^{a}±0.69	100.00^{a}±0.00
3 (11)	0.98^{b}±0.22	2.69^{b}±0.81	3.89^{b}±1.21	5.02^{ab}±1.43	84.84^{ab}±26.31
4 (7)	1.16^{ab}±0.14	3.36^{a}±0.71	4.60^{ab}±0.93	5.75^{ab}±1.06	78.57^{b}±26.72
7 (5)	1.07^{ab}±0.20	3.02^{ab}±0.59	4.35^{ab}±0.83	5.58^{ab}±1.21	100.00^{a}±0.00
11 (4)	1.07^{ab}±0.90	3.06^{ab}±0.25	4.36^{ab}±1.33	5.62^{ab}±1.98	87.50^{ab}±25.11
12 (2)	0.83^{b}±0.04	2.20^{b}±0.28	3.15^{b}±0.41	4.28^{b}±0.40	100.00^{a}±0.00
32 (5)	1.15^{ab}±0.33	2.88^{b}±1.00	4.28^{ab}±1.43	5.74^{ab}±2.24	100.00^{a}±0.00
Pooled	1.03±0.28	2.92±0.41	4.33±1.05	5.57±1.23	92.98±7.61

The figure in the parenthesis indicates the number of observations; Means with different superscript (s) in the same column differ significantly ($p<0.05$)

Table 3 represents the effect of buck on the growth performance and survivability of kids. Buck had a significant effect on the birth weight of the kids and the overall birth weight was found 1.03 kg. The highest birth weight found was 1.38 kg in the case of buck ID No. 1. Similarly, Buck had a significant effect on 30th, 60th, and 90th-day body weight and subsequently on the survivability of the kids.

Dam's milk yield had a significant effect on 30th, 60th, and 90th-day body weight as well as on survivability of the kids. Ignoring the effect of dam's milk yield, the average body weight on 30th, 60th, and 90th day was 2.96±0.68, 4.08±0.85, and 5.24±1.16 kg respectively (table 4). The highest survivability of the kids was found in dams with >600 ml yield per day.

Table 4: Effect of milk yield of does on growth performance and survivability of kids

Dam's milk yield (g/day)	30 days body wt. (kg)	60 days body wt. (kg)	90 days body wt. (kg)	Survivability (%)
<200 (17)	2.75^{b}±0.79	3.73^{b}±1.19	4.69^{b}±1.32	81.37^{c}±26.27
201-400 (23)	2.86^{b}±0.79	4.24^{b}±1.19	5.38^{a}±1.62	95.65^{b}±14.40
401-600 (7)	2.67^{b}±1.20	3.58^{b}±1.04	4.64^{b}±1.73	92.85^{b}±18.89
>600 (1)	3.75^{a}±0.69	4.80^{a}±0.71	6.26^{a}±0.62	100.00^{a}±0.00
Pooled	2.96±0.68	4.08±0.85	5.24±1.16	92.46±14.89

Figure in the parenthesis indicates the number of observations; Means with different superscript (s) in the same column differ significantly ($p<0.05$)

BCS-2

BCS-3

BCS-4

Table 5: Effect of body condition score of does on growth performance and survivability of kids

Dam's BCS	Birth wt. (kg)	30 days body wt. (kg)	60 days body wt. (kg)	90 days body wt. (kg)	Survivability (%)
2 (20)	0.97^{a}±0.20	2.51^{b}±0.75	3.63^{b}±1.02	4.60^{b}±1.41	95.00^{a}±15.00
3 (13)	1.02^{a}±0.26	2.75^{a}±0.82	4.05^{a}±1.18	5.10^{a}±1.46	91.02^{a}±22.17
4 (3)	1.10^{b}±0.30	2.66^{b}±1.05	3.86^{ab}±1.38	4.62^{b}±1.65	66.66^{b}±28.86
Pooled	1.03±0.25	2.64±0.87	3.84±1.19	4.77±1.50	84.4±19.00

The figure in the parenthesis indicates the number of observations; BCS = Body condition score; Means with different superscript (s) in the same column differ significantly ($p<0.05$).

Dam's body condition score had also a significant effect on birth weight, body weight, and survivability of the kids. The birth weight varied from 0.97 kg for body condition score 2 to 1.10 kg for body condition score 4. The average birth weight was noted at 1.03 kg ignoring the effect of the dam's body condition score. In addition to, the highest survivability (95%) of the kids was to be noted in the case of dam's body condition score 2.

Table 6: Effect of parity on growth performance and survivability of kids

Parity	Birth wt. (kg)	30 days body wt. (kg)	60 days body wt. (kg)	90 days body wt. (kg)	Survivability (%)
1 (30)	1.00^{a}±0.22	2.58^{b}±0.77	3.80^{b}±1.10	4.82^{b}±1.38	93.22^{a}±18.38
2 (15)	1.08^{b}±0.26	2.96^{b}±0.84	4.17^{b}±1.14	5.34^{b}±1.69	83.33^{b}±24.39
3 (1)	1.30^{b}±0.18	4.80^{a}±0.61	6.70^{a}±0.81	7.94^{a}±1.11	100.00^{a}±12.36
Pooled	1.12±0.16	3.44±0.53	4.89±0.74	6.03±1.20	92.18±14.25

The figure in the parenthesis indicates the number of observations; Means with different superscript (s) in the same column differ significantly ($p<0.05$)

Table 6 shows the effect of parity on the growth performance and survivability of kids. Dam's parity had also a significant effect on birth weight, body weight, and survivability of the kids. The highest birth weight was found at 1.30 kg in the case of the dam in the 3rd parity. The average body weight on the 30th, 60th, and 90th day was found 3.44±0.53, 4.89±0.74, and 6.03±1.20 kg respectively, ignoring the effect of parity of the dams. On the other hand, the highest survivability was found in the case of the dam in the 3rd parity.

Discussion

Effect Of Parity and Body Condition Score on Litter Size

In this study, it was found that the average litter size of Black Bengal goats was 1.50 which is almost similar to the results of Ali *et al*. (2016), Hasan *et al*. (2015), Haque (2014), Mia (2011), and Amin *et al*. (2000) whose values were 1.81, 1.06, 1.6, 1.5, and 1.86, respectively. The average litter size increased significantly ($p<0.05$) from first parity to third parity. This result was in agreement with the result of Chowdhury *et al*. (2002) who reported that up to third parity, the number of kids born increased linearly ($r^2=0.91$, $p<0.01$) from 1.08 to 1.96 kids. Many other authors like Sodiq *et al.* (2003), Das (1993), and Awemu *et al*. (2002) also stated similar findings. Muthukumar *et al*. (2016), found that the maximum survivability in the fifth parity (98.10%) was followed by the fourth (92.12%) then the third (90.09%), and second (84.62%) and first (63.16%) parity. On the contrary Butswat *et al.* (1995) observed decreased kid survivability with increasing parity due to the increase in litter size as the parity advances. Farzin *et al*. (2017) stated that the body condition score has a significant effect on litter size and they found 1.25±0.16, 1.70±0.10, 1.76±0.05, 1.03±0.14, 1.09±0.12 in case of the dam having body condition score of 5, 4, 3, 2, and 1 and is higher than the current study.

Effect of Buck, Parity, Body Condition Score, and Dam's Milk Yield on Birth Weight and Growth Performance

The variations in the body weight of progenies of different bucks were found significant ($p<0.05$) from birth to 3-months of age and the average birth weight of Black Bengal kids was recorded at 1.03 kg which is in concordance with the results of Ali *et al*. (2016), Bhowmik *et al.* (2014), Mia (2011), and Haque (2014) who found 0.96, 0.89, 1.01, and 1.08 kg, respectively. Farzin *et al.* (2017) stated that the body condition score has a significant effect on birth weight and found 3.28±0.07, 3.34±0.04, 3.31±0.02, 3.15±0.04, and 3.03±0.07 kg which is higher than the findings of the present study. The birth weights of kids at first parity were significantly ($p<0.05$) higher than the kids at second parity which is similar to the results of Hasan *et al.* (2015). The mean body weight at 3-months of age was found 5.40 kg which is higher than the findings of Ali *et al*. (2016), Islam (2016), and Rahman (2007) who reported 4.17, 4.25, 4.67±0.15, and 4.26±0.25 kg, respectively.

Effect of Parity and Body Condition Score on Daily Milk Yield

In the present study, the average daily milk yield was found 303 ml which is higher than the results of Husain (1993), Bhowmik *et al.* (2014), Haque (2014), Ali *et al.* (2016), and Islam *et al.* (2009) whose values were 221, 158, 275, 214, 247 and 162 ml, respectively. Libis *et al.* (2021) stated that the parity had markedly affected the milk production of ewes. The ewes in the third parity had significantly higher daily milk yield (0.91 kg) in comparison to ewes in the first parity (0.76 kg) and the value is quite high than the findings of this study. On the other hand, Špehar et al. (2019) found 1.05±0.39, 1.11±0.49, and 1.13±0.53 ml daily milk yield in case of 1st, 2nd, and 3rd parity of Istrian ewes, which is in contrary to the findings of the present study. Moreover, the first parity had a lower milk yield than the third parity which is similar to the findings of Zamuner *et al.* (2020), Garcia *et al.* (1976), Butswat *et al.* (2002). However, the difference between first and third parity gradually decreased as goats advanced into lactation. In addition, doe's body condition scores significantly influence the milk yield that increased with an increase in the doe's body condition score. Zahraddeen *et al.* (2009) observed that the partial daily milk yield was 184.53±1.39, 186.31±1.56, and 193.81±1.56 ml respectively in local goats of Nigeria with dam's body condition score 2, 3, and 4 that was lower than results of the present study.

Effect of Parity, Body Condition Score, and Doe's Milk Yield on Kid Survivability

The overall survivability rate of Black Bengal goat up to 3-month of age was found 92% which is almost comparable with the findings of Ali *et al.* (2016), Islam *et al.* (2009), Hasan *et al*. (2014), Tsedeke (2007) and these values were 80, 83, 85, 85, and 92%, respectively. Hasan *et al.* (2015) stated that the parities had a significant effect ($p<0.05$) on kid survivability which is similar to the findings of the present study. Husain *et al*. (1995) found 68.0±4.1, 71.6±3.8, and 75.3±4.4% survivability of kids from birth to 3-months of age with the dam's parity 1, 2, and 3. Moaeen-ud-Din *et al.* (2008) reported that the survival rate (SR) of kids is negatively associated with parity and litter size because as parity increased, there was an increase in litter size which is also negatively correlated to survival rate as indicated by Sarmah *et al.* (1981) and Wilson and Murayi (1988). The twins or triplets' kids tended

to have lower birth weights as a result kid mortality increased. However, the mortality rate of kids decreased with the increase of dam milk yield. The survival was lower with a milk yield of <200 ml compared to milk yield >600 ml per day. Therefore, milk yield had a significant effect on kid survivability concede to the results of Subramaniyan *et al.* (2016), Mia *et al.* (2011) Husain *et al*. (1995), and Singh *et al*. (2008).

Conclusions

The survivability and growth performance of kids were significantly affected by buck, milk yield, body condition score, and parity of the does. Moreover, the litter size and milk yield of the does were also significantly affected by body condition score and parity of the dams. The highest milk yield was found in dams having body condition score 4 and parity 2. Therefore, it can be concluded that many factors affect the milk yield of the does and growth performance of the kids, and these should be kept in mind to maximize the growth performance of Black Bengal goats.

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Contribution of Authors

MS Begum conducted the study, collected, and wrote the manuscript. MY Ali analyzed the data and also rewrites the manuscript as well as handles all aspects of this study. SAM Hoque revised the manuscript. MAMY Khandoker supervised all aspects of the study design.

Conflict of Interests

There is no conflict of interest.

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